A note on detection of the Common Dunnart *Sminthopsis murina* (Dasyuromorphia: Dasyuridae) using artificial shelter objects as a survey technique

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ABSTRACT

The widespread Common Dunnart *Sminthopsis murina* is typically only infrequently found during trapping studies. Pitfall trapping is generally considered a more reliable trapping method for dunnarts than Elliott-type box traps, but is often time consuming and labour-intensive. This short paper documents incidental records of *S. murina* detected using artificial shelter objects established during herpetofauna surveys in the Pilliga forest, in northern inland New South Wales, and discusses the potential value of this survey technique as a complement to conventional trapping methods when conducting surveys for dunnarts

Key words: Common Dunnart, *Sminthopsis murina*, artificial shelter objects, survey technique, animal ethics, Pilliga forest.

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Introduction

The Common Dunnart *Sminthopsis murina* (Waterhouse, 1838) (Figure 1), a small insectivorous dasyurid marsupial, is widespread in south-eastern mainland Australia but is only infrequently recorded and little has been published on its ecology (Monamy and Fox 2005). Dunnarts (*Sminthopsis* spp.) as a group are notoriously trap-shy and can be difficult to detect (Kutt *et al.* 2005; Monamy and Fox 2005). They can be captured in Elliott-type box traps (Elliott Scientific Equipment, Upwey, Victoria) (King 1980; Wilson *et al.* 1986; Lunney *et al.* 1987; Tasker and Dickman 2002; Monamy and Fox 2005) but are generally more readily detected in pitfall traps (Bennett *et al.* 1989; Clemann *et al.* 2005; Letnic and Dickman 2005; Ellis 2013). The construction of pitfall traps, however, is relatively time consuming and labour-intensive, particularly in hard soils or rocky ground.

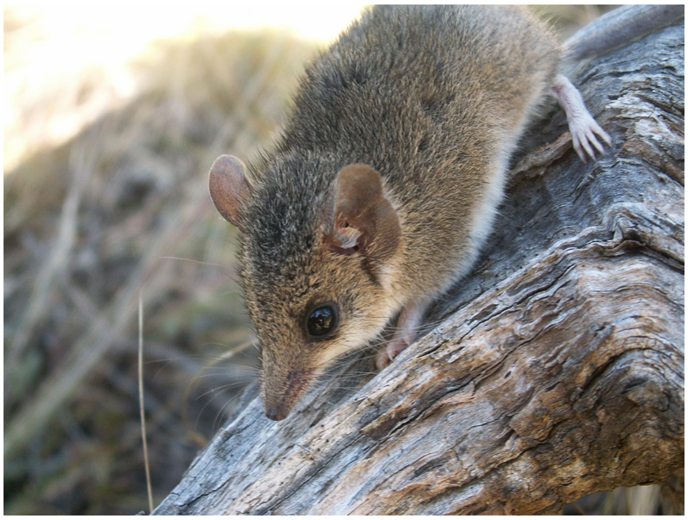

Figure 1. Common Dunnart *Sminthopsis murina* from site 1, Merriwindi SCA, Pilliga forest. Photo, M.J. Murphy, 31 July 2010.

The placement and subsequent inspection of artificial shelter objects is a well-established survey technique for herpetofauna, and has been successfully used to detect a wide range of reptile and amphibian species (e.g. Engelstoft and Ovaska 2000; Marsh and Goicochea 2003; Daly *et al.* 2008; Murphy and Murphy 2011; Michael *et al.* 2012; Ballouard *et al.* 2013). The provision of artificial shelter has been proposed as a potentially effective and less labour-intensive tool for surveying for dunnarts (Nelson and Jemison 2012). Several dunnart species have been opportunistically recorded sheltering by day under natural and anthropogenic objects: the White-footed Dunnart *Sminthopsis leucopus* under large woody debris and sheets of bark on the ground (Lunney and Barker 1987), *Sminthopsis murina* under concrete pavers and discarded sheets of galvanised iron (Homan 2006), and the Fat-tailed Dunnart *Sminthopsis crassicaudata* under a discarded sheet of galvanised iron (Homan and Schultz 2012). Homan (2012) used four types of artificial shelter objects (roofing tiles, concrete pavers, old fence posts and sheets of galvanised iron) to systematically survey small terrestrial vertebrates in south-west Victoria, and recorded *S. crassicaudata* using tiles (eight occasions) and posts (once). The present paper documents incidental observations of *S. murina* using artificial shelter objects placed as part of herpetofauna surveys in the Pilliga forest, in Gamilaraay Aboriginal Country in the Brigalow Belt South bioregion of northern inland New South Wales (NSW). These observations lend further support to the potential value of this survey method for dunnarts, as well as providing additional insight into the ecology of *S. murina*.

Methods

Provision of weathered sheets of corrugated galvanised roofing iron as artificial shelter objects was included as a complementary survey method during herpetofauna surveys in two conservation reserves in the Pilliga forest: Merriwindi State Conservation Area (SCA) (Murphy and Murphy 2015) and Yarrigan National Park (NP) (Murphy in press). Sheets were placed flat on the ground at three sites in Merriwindi SCA and four sites in Yarrigan NP (Figures 2 and 3). The sheets used were salvaged scrap and varied between 1.57 m^2 (183 x 86 cm) and 0.47 m^2 (90 x 52 cm) in size (mean = 0.98 m^2). Three to five sheets were placed within an area of about 25 m^2 at each site, and were inspected at irregular intervals (usually 1 – 5 weeks) over the survey period. During the warmer part of the year, sheets were checked in the morning before the sheet was warmed by the sun, while during the cooler part of the year sheets were checked at any time during daylight hours. The Merriwindi herpetofauna survey had a total of 176 sheet-inspections over January 2010 – June 2011 (Murphy and Murphy 2015) and the sheets were removed at the conclusion of the survey (for re-use in the Yarrigan survey). The Yarrigan herpetofauna survey had 192 sheet-inspections over April 2012 – May 2013 (Murphy in press). The sheets were left in place at the conclusion of the Yarrigan herpetofauna survey, and two sites here were inspected again in November 2015, giving a total of 198 sheet-inspections for Yarrigan NP.

Observations

Sminthopsis murina was incidentally recorded sheltering by day under placed sheets of corrugated iron on a total of seven occasions in the Pilliga forest (Table 1). Three dunnart species are known from northern inland NSW (Van Dyck and Strahan 2008; Atlas of NSW Wildlife 2015). The animals were identified as *S. murina* on the basis of absence of a dark head stripe (as found in the Stripe-faced Dunnart *Sminthopsis macroura*) and the uniformly narrow tail (unlike the swollen tails of *S. crassicaudata* and *S. macroura*). Date of observation ranged from early autumn (March) to late Spring (November). Animals were not individually marked and it is therefore unknown whether any records were recaptures. In Merriwindi SCA the species was seen at one of the three survey sites with an overall average detection rate for the reserve of 0.6 *S. murina*

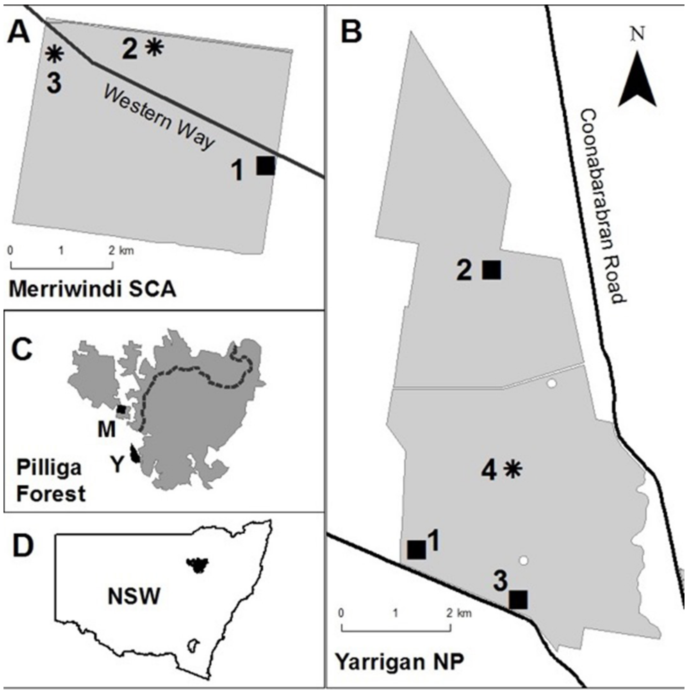

Figure 2. Location of sites where corrugated iron was placed in Merriwindi SCA (map A) and Yarrrigan NP (map B) in the Pilliga forest. Sites where *Sminthopsis murina* was seen are marked with a black square and sites where it was not seen are marked with an asterix. Sites are numbered as per Table 1. Map C shows the context of Merriwindi SCA (M) and Yarrigan NP (Y) in the Pilliga forest. The dotted line marks the boundary between the sandstone country of the south-east Pilliga and the outwash plain in the west and north. Map D shows the location of the Pilliga forest in NSW.

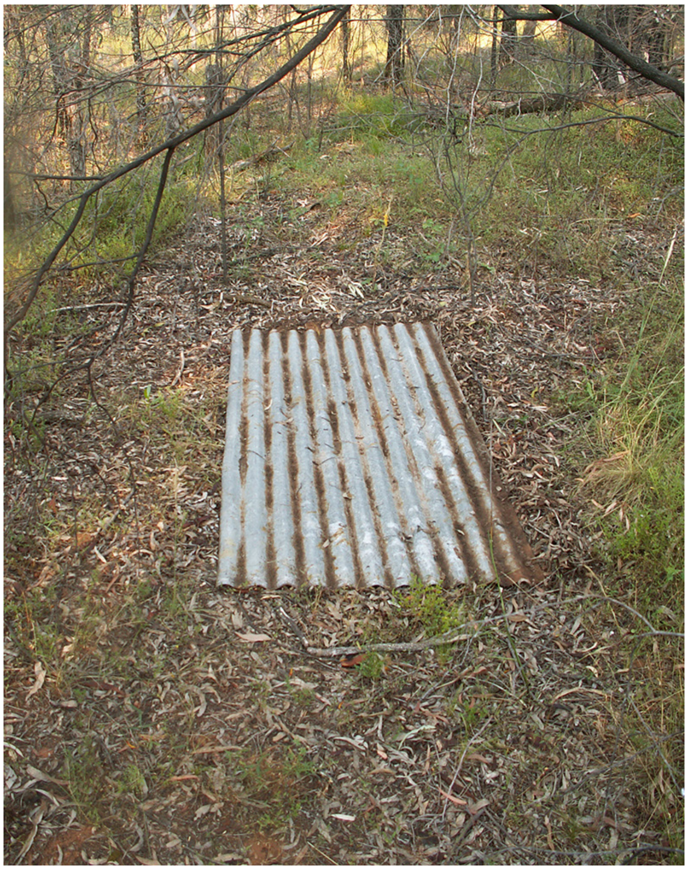

Figure 3. Sheet of weathered corrugated roofing iron used as artificial shelter survey method during herpetofauna survey, Yarrigan NP. This particular sheet was utilised as a maternity day-nest by *Sminthopsis murina*. Photo, M.J. Murphy, 20 November 2015.

Table 1. Records of *Sminthopsis murina* under placed sheets of corrugated roofing iron in the Pilliga forest.
Vegetation type: 1 = Pilliga Box *Eucalyptus pilligaensis* - White Cypress Pine *Callitris glaucophylla* woodland; 2 = Narrow-leafed Ironbark *Eucalyptus crebra* - White Cypress Pine - Bulloke *Allocasuarina luehmannii* open forest.

Location	Vegetation type	*S. murina* records	Date
Merriwindi SCA			
Site 1	1	1 Adult	31-Jul-2010
Site 2	2	Nil records	-
Site 3	1	Nil records	-
Yarrigan NP			
Site 1	1	1 Adult	18-Apr-2012
Site 2	2	1 Adult	14-Sep-2012
		2 Adults (under separate sheets)	3-Mar-2013
		1 Adult	7-May-2013
Site 3	1	1 Adult with 4 or 5 juveniles	11-Nov-2015
Site 4	2	Nil records	-

records/100 sheet-inspections. In Yarrigan NP *S. murina* was seen at three of the four survey sites with an overall average detection rate for the reserve of 3.0 records/100 sheet-inspections. The record of an adult *S. murina* with juveniles was counted as a single record when calculating detection rate, while the two adults found under separate sheets at one site were counted as two records. Four of the six records in Yarrigan NP were at one site, spread over an eight month period. The adult and juveniles were found in a flattened nest of dry leaves and grass under the corrugated iron (Figure 4). The juveniles were approximately half adult size and moved too quickly when the sheet of corrugated iron was lifted to allow certainty regarding the exact number present. One juvenile was captured by hand and photographed before release (Figure 5). A similar nest was observed at Yarrigan site 2 and also at Yarrigan site 4 (where no animals had been detected).

Discussion

The incidental observations recorded here contribute to our understanding of the ecology of *Sminthopsis murina*. The species has previously been recorded in the Pilliga forest; however, these are the first documented records in both Merriwindi SCA and Yarrigan NP (Atlas of NSW Wildlife 2015). The record of an adult (presumably a female) with a litter of dependent juvenile young in November is consistent with the species' August-January breeding season reported by Monamy and Fox (2005). Fox (2008) noted that *S. murina* typically constructs a cup-shaped day-nest of dried grass and leaves in natural refuges such as fallen hollow logs, clumps of grass, grass-trees or under fallen bark or groundcover. *Sminthopsis leucopus* day-nests have been found under large woody debris and sheets of bark on the ground (Lunney and Barker 1987). The observations reported here indicate that *S. murina* also constructs and occupies day-nests under sheets of corrugated iron on the ground.

Sminthopsis murina has been described as a species only infrequently encountered during trapping studies (Monamy and Fox 2005). Tasker and Dickman (2002) reported a

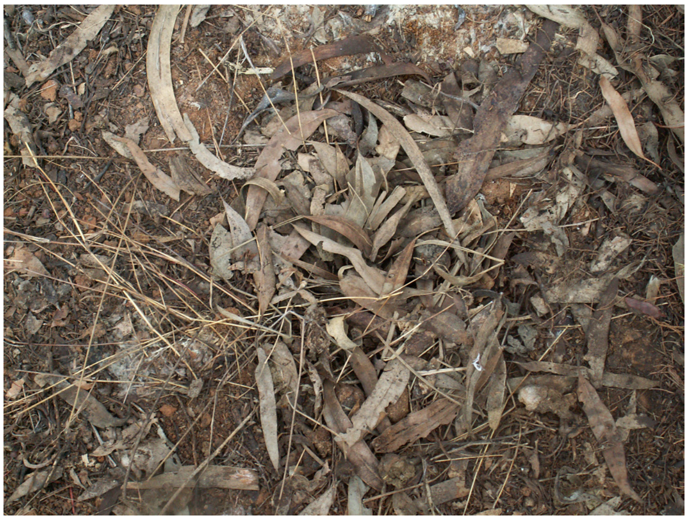

Figure 4. Day-nest of *Sminthopsis murina* under sheet of corrugated iron, Yarrigan NP. Photo, M.J. Murphy, 20 November 2015.

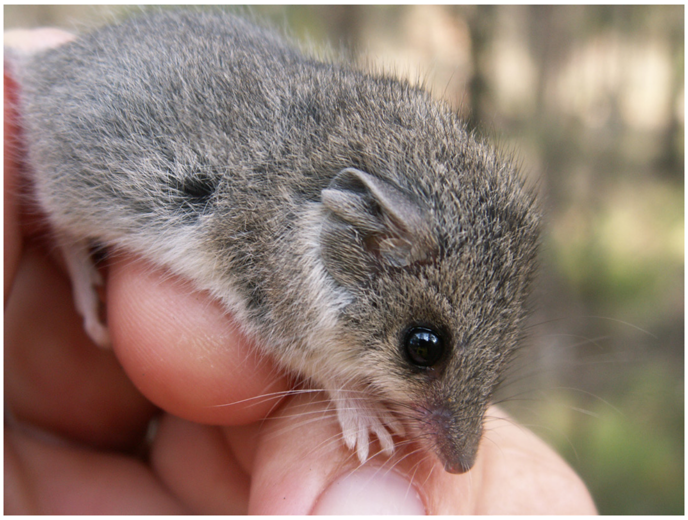

Figure 5. Juvenile *Sminthopsis murina* from site 3, Yarrigan NP, Pilliga forest. Photo, M.J. Murphy, 11 November 2015.

detection rate for *S. murina* in northern NSW of only 0.01 records/100 Elliott trap-nights (based on 8230 trap-nights and with extra care taken in trap placement). Monamy and Fox (2005) studied a high-density sub-adult population of *S. murina* in coastal heath regenerating after fire on the NSW north coast, with a detection rate of 2.9 records/100 Elliott trap-nights. Ellis (2013) reported a detection rate for *S. murina* in western NSW of 0.3 records/100 pitfall trap-nights. Several other dunnart species have proved similarly elusive. *Sminthopsis leucopus* was detected at 0.3 records/100 Elliott trap-nights at sites on the NSW south coast (King 1980; Lunney *et al.* 1987) and 1.5 records/100 pitfall trap-nights in eastern Victoria (Bennett *et al.* 1989). *Sminthopsis crassicaudata* was detected at 0.2 records/100 pitfall trap-nights in western Victoria (Clemann *et al.* 2005) and western NSW (Ellis 2013), and *S. macroura* at 0.05 records/100 pitfall trap-nights in western NSW (Ellis 2013). The detection rates for *S. murina* of 0.6 (Merriwindi SCA) and 3.0 (Yarrigan NP) records/100 sheet-inspections reported here are therefore comparatively high.

Homan (2012) recorded *S. crassicaudata* using placed artificial shelter objects at a site in south-west Victoria with a detection rate of about 0.3 records/100 roofing tile-inspections and 0.1 records/100 wooden post-inspections. Again, these detection rates are lower than reported here for *S. murina* in the Pilliga forest. Twenty-seven sheets of galvanised iron concurrently set at the same site in south-west Victoria and inspected on 19 occasions (giving 513 sheet-inspections) failed to detect any *S. crassicaudata* (Homan 2012), despite the species being known to use this form of shelter (Homan and Schultz 2012).

Conclusion

The observations on *S. murina* reported here, together with the work on *S. crassicaudata* by Homan (2012), support the suggestion by Nelson and Jemison (2012) that the use of artificial shelter objects may be a useful technique for the detection of dunnarts. Animals (including dunnarts) sheltering under artificial shelter objects are usually readily captured by hand (Murphy pers. obs.), enabling additional data such as sex, age, weight, reproductive condition or tissue samples to be collected if required. In addition to the time and labour savings relative to conventional Elliott and pitfall trapping, artificial shelter objects have significant animal ethics advantages as the animals are free to come and go (Nelson and Jemison 2012), rather than waiting in a trap until the next visit by the researcher. Furthermore, artificial shelter objects can have functional benefits by replacing lost natural shelter features in degraded environments (Homan 2012), or providing additional protection from predators for vulnerable life-stages of threatened fauna (Ballouard *et al.* 2013). Sampling artificial cover objects at a frequency of no more than once per week, as recommended by Marsh and Goicochea (2003), is probably a useful guide. Numerous studies have demonstrated the value of employing a range of complementary methods in fauna surveys to maximise the likelihood of species detection (e.g. Catling *et al.* 1997; Parris *et al.* 1999; Swan and Foster 2005; Garden *et al.* 2007; Murphy and Murphy 2011). There is at present insufficient detail available concerning the specific type of artificial shelter object to use to optimally target particular dunnart species in particular environments. Nevertheless, the use of artificial shelter objects should be considered as a complementary survey method to conventional trapping when conducting surveys for dunnarts.

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